

Chapter 10

Paleontological Resources

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Paleontological Resources

This chapter analyzes the proposed action's potential effects on paleontological resources. Related information, including an overview of bedrock and Quaternary geology in the action area, is presented in Chapter 7 (*Geology and Soils*). Cultural resources are addressed separately in Chapter 9.

For the purposes of this analysis, *paleontological resources* is defined as including fossilized remains of vertebrate and invertebrate organisms, fossil tracks and trackways, and plant fossils. Because of the action area's size and geologic diversity, detailed investigation of paleontological resources in the action area is beyond the scope of this EIS/EIR. Instead, this analysis focused on developing a strategy to (1) assess risks to nonrenewable paleontological resources and (2) avoid and minimize impacts. Key information used in the preparation of this chapter was derived from published geologic literature and maps, and from guidelines published by the Society of Vertebrate Paleontology (SVP). Specific reference information is provided in the text.

Affected Environment

Regulatory Framework

A variety of federal, state, and local regulations and policies protect paleontological resources. These include NEPA, CEQA, the federal Antiquities Act of 1906, the National Natural Landmarks (NNL) Program, the California Public Resources Code, and the recently enacted federal Paleontological Resources Preservation Act. Professional standards of practice such as those adopted by SVP (Society of Vertebrate Paleontology Conformable Impact Mitigation Guidelines Committee 1995) offer additional guidance for control and mitigation of adverse impacts on paleontological resources. The following paragraphs describe key regulatory provisions relating to paleontological resources.

Federal Regulations

Antiquities Act

As discussed in Chapter 9 (*Cultural Resources*), the federal Antiquities Act of 1906 was enacted with the primary goal of protecting cultural resources in the United States. As such, it explicitly prohibits appropriation, excavation, injury, and destruction of “any historic or prehistoric ruin or monument, or any object of antiquity” located on lands owned or controlled by the federal government, without permission of the secretary of the federal department with jurisdiction. It also establishes criminal penalties, including fines and/or imprisonment, for these acts. Neither the Antiquities Act itself nor its implementing regulations (Title 43, Code of Federal Regulations [CFR], Part 3) specifically mentions paleontological resources. However, several federal agencies—including the National Park Service, the Bureau of Land Management, and the U.S. Forest Service—have interpreted *objects of antiquity* as including fossils. Consequently, the Antiquities Act represents an early cornerstone for efforts to protect the nation’s paleontological resources.

National Environmental Policy Act

NEPA does not provide specific guidance regarding paleontological resources, but the NEPA requirement that federal agencies take all practicable measures to “preserve important historic, cultural, and natural aspects of our national heritage” (NEPA Sec. 101[b][4]) is interpreted as applying to paleontological materials. Under NEPA, paleontological resources are typically treated in a manner similar to that used for cultural resources.

Paleontological Resources Preservation Act

The federal Paleontological Resources Preservation Act of 2002 (PRPA) was specifically intended to codify the generally accepted practice of limiting collection of vertebrate fossils and other rare and scientifically significant fossils to qualified researchers who obtain a permit from the appropriate state or federal agency and agree to donate any materials recovered to recognized public institutions where they will remain accessible to the public and to other researchers. The PRPA incorporates the following key findings of a recent report issued by the Secretary of the Interior with input from staff of the Smithsonian Institution, the U.S. Geological Survey, various federal land management agencies, paleontological experts, and the public (Society of Vertebrate Paleontology 2003).

- Most vertebrate fossils, and some fossils of other types (invertebrates, plants) represent a rare resource.
- Illegal collection and theft of fossil materials from public lands is a serious problem; penalties for fossil theft should be strengthened.

- Effective stewardship requires accurate information; federal fossil collections should be preserved and made available for research and educational use.
- Federal management of fossil resources should emphasize opportunities for public involvement.

National Natural Landmarks Program

The NNL Program was established in 1962 under authority of the Historic Sites Act of 1935. Following are the goals of the NNL Program.

- To encourage the preservation of sites that illustrate the nation's geological and ecological character.
- To enhance the scientific and educational value of the sites preserved.
- To strengthen public appreciation of natural history and foster increased concern for the conservation of the nation's natural heritage.

Under the NNL Program, sites that represent the nation's "best" examples of various types of biological communities or geologic features (meaning that they are in good condition and effectively illustrate the specific character of a certain type of resource) are listed on the National Registry of Natural Landmarks (NRNL). At present, the NRNL includes 587 sites, ranging in size from 7 acres to almost 1 million acres. Examples of sites designated as NNLs for their paleontological value include Sharktooth Hill in Kern County, Rancho La Brea in Los Angeles, and Rainbow Basin north of Barstow in San Bernardino County.

The NNL Program is administered by the National Park Service. However, most sites listed on the NRNL are not transferred to federal ownership and most do not become units in the National Parks system; most continue to be managed by their current owners following listing. At present, about 50% of the nation's NNLs are managed by public agencies, about 30% are privately owned and managed, and about 20% are managed through collaboration between agencies and private entities.

The National Park Service (NPS) is responsible for maintaining relationships with NNL landowners and monitoring the condition of all NNLs. Based on its monitoring, NPS prepares an annual report for transmission via the Secretary of the Interior to Congress, identifying NNLs at risk of damage or degradation.

State Regulations and Policies

California Environmental Quality Act

CEQA includes in its definition of *historical resources* "any object [or] site ... that has yielded or may be likely to yield information important in prehistory" (CEQA Guidelines Sec. 15064.5[3]), which is typically interpreted as including fossil materials and other paleontological resources. In addition,

destruction of a “unique paleontological resource or site or unique geologic feature” constitutes a significant impact under CEQA (CEQA Guidelines Appendix G). Treatment of paleontological resources under CEQA is generally similar to treatment of cultural resources, requiring evaluation of resources in a project’s area of potential affect, assessment of potential impacts on significant or unique resources, and development of mitigation measures for potentially significant impacts, which may include monitoring combined with data recovery and/or avoidance.

California Public Resources Code

Several sections of the California Public Resources Code protect paleontological resources. Section 5097.5 prohibits “knowing and willful” excavation, removal, destruction, injury, and defacement of any paleontologic feature on public lands (lands under state, county, city, district, or public authority jurisdiction, or the jurisdiction of a public corporation), except where the agency with jurisdiction has granted express permission. Section 30244 requires reasonable mitigation for impacts on paleontological resources that occur as a result of development on public lands. The sections of the California Administrative Code relating to the State Division of Beaches and Parks afford protection to geologic features and “paleontological materials” but grant the director of the state park system authority to issue permits for specific activities that may result in damage to such resources, if the activities are in the interest of the state park system and for state park purposes (California Administrative Code Sec. 4307–4309).

Local Regulations and Plans

Many County and City general plans specifically protect paleontological resources. In addition, general plan and local ordinance protection for cultural and “heritage” resources also covers paleontological resources in some jurisdictions. The goal of general plan policies is typically to recognize the importance of these resources as part of a jurisdiction’s unique character and heritage, and to ensure that they are preserved as development proceeds. Some jurisdictions also emphasize the need to increase public awareness of such resources.

Professional Standards and Guidelines

In response to a recognized need for standard guidance, the SVP published a set of *Standard Guidelines* (Society of Vertebrate Paleontology Conformable Impact Mitigation Guidelines Committee 1995) that are now widely followed. The SVP guidelines identify two key phases in the process for protecting paleontological resources from project impacts, as follows.

1. Assess the likelihood that the project's area of potential effect contains significant nonrenewable paleontological resources that could be directly or indirectly impacted, damaged, or destroyed as a result of the project.
2. Formulate and implement measures to mitigate potential adverse impacts.

An important strength of the SVP's approach to assessing potential impacts on paleontological resources is that the SVP guidelines provide some standardization in evaluating a project area's paleontological sensitivity. Table 10-1 defines the SVP's sensitivity categories for paleontological resources and summarizes SVP's recommended treatments to avoid adverse impacts in each sensitivity category.

Table 10-1. Society of Vertebrate Paleontology's Recommended Treatment for Paleontological Resources, by Sensitivity Category

Sensitivity Category	Definition	Recommended Treatment
High potential (High sensitivity)	Areas underlain by geologic units from which vertebrate or significant invertebrate fossils or suites of plant fossils have been recovered.	<ul style="list-style-type: none"> ▪ Preliminary survey and surface salvage before construction begins. ▪ Monitoring and salvage during construction. ▪ Specimen preparation; identification, cataloging, curation, and storage of materials recovered. ▪ Preparation of final report describing finds and discussing their significance. ▪ <i>All work should be supervised by a professional paleontologist who maintains the necessary collecting permits and repository agreements.</i>
Undetermined potential (Undetermined sensitivity)	Areas underlain by geologic units for which little information is available.	<ul style="list-style-type: none"> ▪ Preliminary field surveys by a qualified vertebrate paleontologist to assess project area's sensitivity ▪ Design and implementation of mitigation if needed, based on results of field survey
Low potential (Low sensitivity)	Areas underlain by geologic units that are not known to have produced a substantial body of significant paleontologic material.	Protection and salvage are generally not required. However, a qualified paleontologist should be contacted if fossils are discovered during construction, in order to salvage finds and assess the need for further mitigation.

Source: Society of Vertebrate Paleontology Conformable Impact Mitigation Guidelines Committee 1995.

SVP's guidelines also provide a working definition of *significance* as applied to paleontological resources. According to SVP, significant paleontological resources are those that fulfill one or more of the following criteria (Society of Vertebrate Paleontology Conformable Impact Mitigation Guidelines Committee 1995).

- Provides important information shedding light on evolutionary trends and/or helping to relate living organisms to extinct organisms.
- Provides important information regarding the development of biological communities.
- Demonstrates unusual circumstances in the history of life.
- Represents a rare taxon or a rare or unique occurrence; is in short supply and in danger of being destroyed or depleted.
- Has a special and particular quality, such as being the oldest of its type or the best available example of its type.
- Provides important information used to correlate strata for which it may be difficult to obtain other types of age dates.

Significant paleontological resources may include vertebrate fossils and their associated taphonomic and environmental indicators; invertebrate fossils; and/or plant fossils.

Existing Conditions

Paleontological Resources in the Action Area

A number of geologic units in the action area have some potential to contain significant paleontological resources. These include the Cretaceous Moreno Formation along the northwest margin of the action area; various other marine units of Cretaceous and Paleogene age, primarily exposed at the surface along the west margin of the action area and also present in the subsurface throughout the Central Valley; Neogene marine and terrestrial strata exposed along the Valley margins and present in the subsurface throughout the Valley, including the Temblor Formation of Early to mid-Miocene age; and valley-filling Pleistocene alluvial units. The following sections provide additional information on the Moreno Formation, Temblor Formation, and Pleistocene alluvium, which are considered particularly sensitive on a regional basis. Other units are also locally sensitive.

Moreno Formation

The Moreno Formation consists of shale deposited in a deep-marine environment. It is highly fossiliferous, yielding a variety of marine reptiles; fish skeletons; various marine invertebrates; plant remains, including wood, leaves, and needles; and the remains of dinosaurs (Hilton 2003). Fossil remains from 5 types of hadrosaur dinosaurs, 20 plesiosaurs and 84 mosasaurs (marine reptiles), and several turtles have been collected from the Moreno Formation in Fresno County, many from the Panoche Hills area (Hilton 2003). Dinosaurs are rarely found in California and many of the plesiosaurs and mosasaurs found in California come from the Moreno Formation (Discovery Works 2003). Various

molluscs, fish, and crabs have also been recovered from the Moreno Formation (Payne 1962).

An assemblage of bivalves interpreted to be from an ancient cold seep has been discovered in the upper Moreno Formation in the Panoche Hills area (Weberling and Moore 2003). Modern cold seeps were discovered relatively recently (in the late 1980s), and paleontologists are just beginning to recognize them in the fossil record (Campbell and Bottjer 1993, Campbell et al. 1993). Fossil cold seep faunas are thus unusual and potentially important fossils that can add to our understanding of evolutionary processes and ancient geochemistry.

Because it contains abundant vertebrate fossils as well as potentially important invertebrate faunas, the Moreno Formation is evaluated as having high potential to contain significant paleontological resources. Its paleontological sensitivity is considered high.

Temblor Formation

The Temblor Formation consists of sandstone and siltstone deposited in a nearshore marine environment. It is famous for the richness and diversity of its fossil assemblage, which includes evidence of large land mammals such as horses (e.g., *Merychippus* sp.), marine mammals such as cetaceans and the sea cow *Desmostylus*; sharks; birds, including a new genus and species of condor-like vulture identified in part from remains in the Temblor Formation; and marine invertebrates (Garrison 1959, Norris and Webb 1990, Emslie 1988, Barnes et al. 2005). Exposures of the Temblor Formation at Sharktooth Hill in Kern County have been designated as an NNL (see *National Natural Landmarks Program* in *Regulatory Context* above) because of their remarkable fossil content.

Pleistocene Alluvial Units

As discussed in Chapter 7, the Quaternary alluvial and fluvial strata flooring the Central Valley record erosional dissection of the Sierran and Coast Ranges uplifts. Fossil remains of vertebrates are common in Pleistocene units throughout California, and Pleistocene alluvial units in particular can contain diverse vertebrate faunas representing various evolutionarily important taxa. Sloths, horses, camels, mammoths, and bison have been collected from middle to late Pleistocene sediments in all of the action area counties (Jefferson 1991, Dundas et al. 1996, Hilton et al. 2000).

PG&E's Existing Facilities

As described in Chapter 1, PG&E has facilities in all portions of the action area, which was defined on the basis of PG&E's infrastructure network. Many of the facilities were constructed prior to 1970, so no NEPA or CEQA analysis of construction effects on paleontological resources at these sites was required.

Consequently, the extent and significance of any paleontological resources that may have existed prior to construction on the sites is unknown, and an unknown amount of damage to paleontological resources at these sites may have occurred as a result of construction-related ground disturbance. As a result, some existing paleontological resources may already have been substantially disturbed, damaged, or destroyed. However, there is the potential that others may remain intact or largely undisturbed.

Environmental Consequences and Mitigation Strategies

Methodology for Impact Analysis

Impacts on paleontological resources were analyzed qualitatively, based on professional judgment.

As discussed above, some of the action area's geologic units are known to be highly sensitive paleontologically. However, because of the action area's size and geologic diversity, detailed investigation of paleontological resources—which would typically result in site-specific assessments of paleontological sensitivity followed by development of corresponding site-specific avoidance and/or treatment protocols—was infeasible. Instead, this analysis focused on (1) identifying activities with the potential to disturb, damage, or destroy paleontological resources if any are present on the work site; and (2) developing a strategy to ensure that mitigation requiring paleontological sensitivity assessment and appropriate treatment developed on a site-specific basis is in place for those activities identified as likely to result in damage.

Significance Criteria

Based on the state's CEQA Guidelines and standards developed by SVP (Society of Vertebrate Paleontology Conformable Impact Mitigation Guidelines Committee 1995), this analysis evaluated an impact as *significant* if it would have the potential to result in

- substantial damage to or destruction of significant paleontological resources, as defined in *Regulatory Framework* above.

Impacts and Mitigation Measures

Proposed Action

Impact PAL1—Potential for damage to paleontological resources. As discussed in *Existing Conditions* above, some of the action area's geologic units have the potential to contain significant paleontological resources. Many of the activities that would be enabled by the proposed action would result in some degree of ground disturbance, and thus could damage paleontological resources if any are present on the work site. This is most likely to occur where ground disturbance is greater and the work site has not experienced substantial prior disturbance; thus, the greatest concern focuses on new minor construction activities, which are likely to occur on previously undisturbed, or largely undisturbed, parcels. Substantial damage to or destruction of significant paleontological resources as defined by the SVP (Society of Vertebrate Paleontology Conformable Impact Mitigation Guidelines Committee 1995) would represent a significant impact. In most cases, new minor construction would require preparation of a site-specific geotechnical investigation; **to avoid significant impacts in these cases, PG&E will implement the following measure.**

Mitigation Measure PAL1.1—Include site-specific evaluation of paleontological sensitivity for projects requiring site-specific geotechnical investigation. For any project that requires a site-specific geotechnical investigation under applicable state regulations, applicable local permitting processes, and/or PG&E's standard environmental programs and practices, PG&E will ensure that preconstruction studies include assessment of the site's paleontological sensitivity by a state-registered professional geologist (PG) or qualified professional paleontologist. If the paleontological assessment determines that any of the substrate units that would be affected by the planned activity are highly sensitive for paleontological resources, the report will also include recommendations for appropriate and feasible procedures to avoid or minimize damage to any resources present, prepared by a qualified professional paleontologist. PG&E will be responsible for ensuring implementation of the measures identified.

The potential for significant impacts on paleontological resources as a result of routine O&M activities is lower, because ground disturbance associated with these activities is typically confined to existing ROWs and immediately adjacent areas, which have already undergone some level of disturbance associated with installation and maintenance of existing infrastructure. **To ensure that further ground disturbance does not result in additional, significant damage to paleontological resources, PG&E will also implement the following measure for all activities except emergency repairs;** note that this measure would also ensure against significant impacts as a result of any new minor construction not subject to site-specific geotechnical investigation.

Mitigation Measure PAL1.2—Stop work if substantial fossil remains are encountered during construction. If substantial fossil remains (and particularly, vertebrate remains) are discovered during O&M or construction activities, work on the site will stop immediately until a state-registered professional geologist (PG) or qualified professional paleontologist can assess the nature and importance of the find and a qualified professional paleontologist can recommend appropriate treatment. Treatment may include preparation and recovery of fossil materials so that they can be housed in an appropriate museum or university collection, and may also include preparation of a report for publication describing the finds. PG&E or the appropriate agency will be responsible for ensuring that recommendations regarding treatment and reporting are implemented.

As discussed in Chapters 2 and 9, when emergency repairs are needed, PG&E is required to conduct them as rapidly as possible to ensure continuity of service and protect public safety. As a result, it is typically infeasible to implement a stop work order such as that required under Mitigation Measure PAL1.2 during emergency repairs. By their nature, emergency repairs affect existing infrastructure and thus would take place in ROWs and immediately adjacent areas that have already undergone some level of disturbance associated with installation and maintenance of existing utilities infrastructure. Consequently, the potential for significant impacts as a result of emergency repairs is considered low, but some potential nonetheless remains. Implementation of the following measure would reduce impacts to the extent feasible. **With this measure in place, impacts related to emergency repairs are expected to be less than significant.**

Mitigation Measure PAL1.3—Implement follow-up assessment and remediation in the event paleontological resources are discovered during emergency repairs. If paleontological resources are discovered during emergency repairs, PG&E will ensure that they are evaluated by a state-registered professional geologist (PG) or qualified professional paleontologist as soon as practicable following the completion of all necessary and required repair work. If appropriate, a qualified professional paleontologist will develop a remedial treatment plan consistent with the prevailing standard of care for paleontological resources. The treatment plan may provide for any or all of the following: measures to prevent additional damage; recovery excavations; museum curation; preparation of a report documenting the find; and/or development of public outreach or educational materials or displays. PG&E will be responsible for ensuring that the recommendations of the treatment plan are implemented.

With Mitigation Measures PAL1.1, PAL1.2, and PAL1.3 in place, impacts on paleontological resources as a result of activities enabled under the proposed action are expected to be less than significant.

Alternative 1—HCP with Reduced Take

Alternative 1 would enable the same program of O&M and minor construction activities as that described for the proposed action, with minor differences specific to commitments for the protection of biological resources.

Consequently, impacts on paleontological resources would be essentially the same under Alternative 1 as those described for the proposed action, and the same mitigation strategy would apply.

Alternative 2—HCP with Enhanced Compensation

Alternative 2 would enable the same program of O&M and minor construction activities as that described for the proposed action. Differences between Alternative 2 and the proposed action would center on compensation ratios for habitat disturbed or lost (increased under Alternative 2 by comparison with the proposed action). As with Alternative 1, impacts on paleontological resources would be very similar under Alternative 2 to those described for the proposed action, and the same mitigation strategy would apply.

Alternative 3—HCP with Reduced Number of Covered Species

Alternative 3 would enable the same program of O&M and minor construction activities as that described for the proposed action. The key difference between Alternative 3 and the proposed action would relate to the number of species covered under the Alternative 3 (reduced by comparison with the proposed HCP, as described in Chapter 2). Impacts on paleontological resources would be very similar under Alternative 3 to those described for the proposed action, and the same mitigation strategy would apply.

Alternative 4—No Action

Under the No Action Alternative, PG&E would continue its existing program of O&M activities unchanged. No HCP would be implemented, and no other new or additional environmental commitments would be put in place. However, because the activities most likely to affect paleontological resources would not change substantially, paleontological impacts would be essentially the same as those described for the proposed action. The same mitigation strategy would apply.

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